COMPUTERS AND AUTOMATION

CYBERNETICS · ROBOTS · AUTOMATIC CONTROL

Vol. 3, No. 5

MAY, 1954

COMPUTERS AND AUTOMATION

CYBERNETICS • ROBOTS • AUTOMATIC CONTROL

Vol. 3, No. 5 May, 1954

Publisher: Edmund C. Berkeley and Associates
36 West 11 St., New York 11, N.Y.
and
815 Washington St., Newtonville 60, Mass.

THE EDITOR'S NOTES

Meetings. Seven meetings in the field of computing machinery and automation scheduled for April, May, and June, have come to our attention:

1. April 12, Philadelphia, Pa., Main Section Meeting, American Institute of Electrical Engineers, "Computers, Yesterday and Tomorrow — A Celebration of Ten Years of Progress", Guest of Honor: Dr. Howard H. Aiken

2. April 13, 14, Cleveland, Ohio, Case Institute of Technology, Case-Industry Conference on "Applications of Computing Machines"

3. May 5 to May 8, Louisville, Ky., Kentucky Hotel, 5th Annual Conference of the American Institute of Industrial Engineers, including a session May 6 on "Automation in Operation"

4. May 12, Syracuse, N. Y., one-day management conference sponsored by the New York State Department of Commerce on "Automation and Industrial Development" (registration by writing to the N. Y. State Department of Commerce, 112 State St., Albany, N. Y.)

5. June 21 to July 2, State College, Pa., The Pennsylvania State University, engineering seminar on "Analog Computers"

6. June 22, 23, Detroit, Mich., Wayne University, Conference on Training Personnel for the Computing Machinery Field

7. June 23, 24, 25, Ann Arbor, Mich., Association for Computing Machinery, 1954 Annual Meeting, program to be announced

It is hoped that many of the talks will be published so that persons who are interested but unable to attend the meetings can find out what has been said.

(continued on page 11)

Notice. COMPUTERS AND AUTOMATION is published ten times a year, monthly except June and August, by Edmund C. Berkeley and Associates, 36 West 11 St., New York 11, N. Y., and 815 Washington St., Newtonville 60, Mass. Subscription rates: $4.50 for one year, $8.50 for two years, in the United States; $5.00 for one year, $9.50 for two years, in Canada; $5.50 for one year, $10.50 for two years elsewhere. Advertising rates: see page 32. Entered as second class matter at the Post Office, New York, N. Y.

Address Changes. If your address changes, please notify us giving both old and new addresses, and allow three weeks for the change.

Back Copies. See the information on page 30.

Manuscripts. We desire to publish articles that are factual, useful, understandable, and interesting to many kinds of people engaged in one part or another of the field of computers and automation. In this audience are many people who have expert knowledge of some part of the field, but who are laymen in other parts of it. Consequently, a writer should seek to explain his subject, and show its context and significance. He should define unfamiliar terms, or use them in a way that makes their meaning unmistakable. He should identify unfamiliar persons with a few words. He should use examples, comparisons, analogies, etc., whenever they may help readers to understand a difficult point. He should give data supporting his argument and evidence for his assertions. An article may certainly be controsial if the subject is discussed reasonably. Ordinarily, the length should be 1000 to 4000 words, and payment will be $10 to $50 on publication. A suggestion for an article should be submitted to us before too much work is done. To be considered for any particular issue, the manuscript should be in our hands by the 5th of the preceding month.

Digital Computer Techniques

Applied to the design, development and application of

Electronic Business Systems

Military Radar Fire Control Systems

Aircraft Control and Navigation Systems

The successful application of Hughes airborne digital computers to high speed aircraft fire control problems has opened up an entire new area for these digital computer techniques.

Similar equipment is now under development in the Advanced Electronics Laboratory to apply such digital computer systems to modern business information handling.

Areas include LOGICAL DESIGN • COMPONENT DEVELOPMENT • PROGRAMMING • MAGNETIC RECORDING • CIRCUIT DESIGN • INPUT & OUTPUT DEVICES • SYSTEMS ANALYSIS • BUSINESS APPLICATIONS ANALYSIS

Hughes *developments in these fields are creating new positions in the Advanced Electronics Laboratory. Exceptional men in the following spheres of endeavor are invited to apply:*

ENGINEERS AND PHYSICISTS

Computer activities embrace systems planning and analysis, design and development, system engineering and component development. Experience in these areas, as well as in application of electronic digital computers, is desirable but not essential. Analytically inclined men with backgrounds in systems work are required for this phase.

COMPUTER APPLICATIONS SPECIALISTS

Experience in the application of electronic digital computers to business problems is desirable, but not essential. Specifically, men are required who can bring ingenuity and a fresh approach to a formulation of fundamental requirements of business data handling and accounting problems.

Hughes

RESEARCH AND DEVELOPMENT LABORATORIES

Scientific and Engineering Staff

Culver City, Los Angeles County, California

FERRITE MEMORY DEVICES

Ephraim Gelbard and William Olander
General Ceramics Corp., Keasbey, N.J.

The applications for computers, and other machines using memory devices for storing information, are far too numerous to list here, but there are several factors which have so far limited the use of these machines. One of the major limiting factors has been the size, speed, cost, and reliability of the memory. A new development in memory devices, commonly known as a magnetic ferrite memory, can now provide a low-cost reliable memory which is at the same time fast and compact. This development originated in the field of solid-state physics and is of major importance.

A ferrite is a ceramic material that is made up of many very small crystals and that exhibits the phenomena of iron magnetism. Its magnetic properties parallel those of the more familiar types of metallic magnetic materials of high efficiency that have been in common use for many years. A ferrite is a chemical compound of metal oxides only, and contains no free metal; therefore, it has high resistance to the conduction of electricity. Thus, a ferrite lends itself to applications involving high frequency currents, due to the absence of eddy current effects that limit ordinary metallic magnetic materials to low frequencies. In the last five years, ferrites have proved their applicability in numerous high frequency applications, notably, in television receivers, in the horizontal deflection transformers and the deflection yokes, and also in antenna devices for radio sets.

Since the material is basically a ceramic product, all of the standard ceramic techniques are applied in their manufacturing. The more important manufacturing processes include mixing of raw materials, molding or extruding to the desired shapes, and firing in a kiln like pottery. The shape most commonly used in computer memory devices is a toroid or ring, sometimes so small that it looks like a very fine bead. Chemical components of the ferrites include iron oxide, nickel oxide, manganese oxide, zinc oxide, magnesium oxide, and other oxides of metals. Physical characteristics of magnetic ferrites are: their color is black; their hardness is between that of glass and diamond; they are chemically inert; and their relative weight is about five times that of water.

A magnetic ferrite for a memory device is made from manganese, magnesium, and iron oxide, and has an extraordinary property: in the language of the physicist, it has a "rectangular hysteresis loop" (see Figure 1). This we shall now explain.

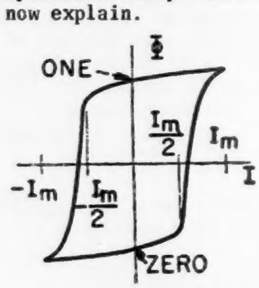


Figure 1.

In Figure 1, the horizontal axis represents the magnitude and direction plus or minus of the current, I, flowing in a copper wire through the ring or wound around the ring. The vertical axis represents, Φ, the magnitude and direction north or south of the magnetization. The curve represents the amount and direction of magnetization in the ferrite ring as the current changes. A positive pulse of current equal in amount to I_m will change the magnetization of the ferrite from "ZERO" up the right-hand side of the curve. If current is now turned off, magnetization will slip back slightly to the point marked "ONE". Next, a pulse of current in the negative direction equal to $-I_m$ will change the magnetization of the ferrite down the left-hand side of the curve producing magnetization of the ferrite in the opposite direction. When this current is turned off, magnetization slips back slightly to the point marked "ZERO". The ferrite in other words "remembers" the last pulse of the current that went through it, according as the pulse of current was positive or negative. But note well from the diagram that a pulse of current equal to one half of I_m is <u>not</u> sufficient to change the magnetization of the core. By the way, the word "hysteresis" meaning "lagging" comes from a Greek word "hysterein" "to lag, to be behind", and does not come from the Greek word "hystera" meaning "womb" and appearing in the word "hysteria".

In other words, when the ferrite is placed in a particular magnetic state, it requires a certain magnitude of input energy to produce a significant change in its magnetic state. Such a change of magnetic state yields output energy in the form of a usable voltage. In Figure 1, it can be seen from the rectangular hysteresis loop that a ferrite has two stable states when no input or exciting energy consisting of electrical current or pulses is applied to the winding on the ferrite (also called a core). The two stable states of magnetic energy with no input energy can be arbitrarily assigned numbers such as "one" and "zero" as shown. By assigning these two states, the device expresses the binary digit system for the storage of information. If a binary digit has been stored into the magnetic core (into the "one" state) by means of energy on a positive current pulse, then the information will stay there indefinitely until a negative current pulse arrives. When this occurs, the magnetic state of the core switches to the "zero" side and a relatively large usable output voltage is produced (called the "one" output; see its graph in Figure 2). It should be kept in mind that only when a core is switched by a negative pulse from the "one" state to the "zero" state does a significant and usable output voltage occur; if the negative pulse finds the core in the "zero" state, then the push of the pulse moves the magnetization to the negative tip of the hysteresis loop and produces very little output voltage (called the "zero" output; see its graph also in Figure 2).

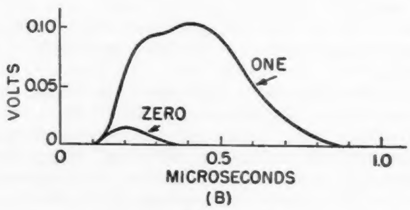


Figure 2.

By this method the core delivers to the rest of the computer as a voltage the information it stored. The "zero" state and the "one" state together make possible the use of the binary digital system.

It can be seen that the stored information is destroyed when taken or read out of the core; however, the electronic circuitry of the memory device can be so arranged that the information in a core can be reentered automatically when it is not desired to erase the memory.

The operation described above refers to just one ferrite core storing one binary digit or bit. However, many thousands of individual cores together can provide tremendous storage capacity. This can be gained by arranging and wiring the cores into arrays of various shapes and sizes to fit the requirements of a particular memory system.

Although there are several magnetic materials which can be used in this application, ferrites with a rectangular hysteresis loop possess considerable advantages. Because of their particular usefulness at high frequencies, they can be used at very high speeds of information-handling, and thus increase the overall efficiency of the computer.

The ferrite cores can be wired criss-cross in a three-dimensional set of planes, (called a matrix) so that many cores receive current pulses of half amplitude, but only one core in each plane receives a coincidence of two half-pulses, thus causing that core alone to switch its magnetic state. This is possible because as pointed out before the cores are insensitive to half-pulses. This system of wiring is commonly known as the coincident-current system.

Each memory plane in a matrix delivers at any one time only one bit of stored information. It is therefore necessary to have a plane for each binary digit required. Thus a sixteen binary digit memory will use 16 planes. The total storage capacity of the matrix then depends upon the number of memory cores in any one plane. At present a plane containing 128 x 128 cores (a total of 16,384 bits) is entirely feasible. A plane containing 64 x 64 cores (4,096 bits) is now successfully in operation. This means that a computer using 16 planes of 64 x 64 cores can store 4,096 numbers each of 16 binary digits. Up to the present time, there have been no known errors in the memory attributable to the ferrite cores.

Until the advent of magnetic core storage, the fastest memory device was of the "electrostatic storage" type. Magnetic core storage in the present state of the art has an access time of about 6 millionths of a second, as compared with electrostatic storage, which has an access time for reading and writing of about 25 millionths of a second. It appears possible to build a magnetic core memory that will have an access time of about 3 millionths of a second.

As the size of a magnetic core memory increases, the total cost per bit of storage decreases. Also, the physical size of a magnetic core memory, including the circuits for driving the cores and reading them, does not increase directly with storage capacity. The figures are as follows. Magnetic memory planes can now be made where the physical space per bit is about one-tenth of a square inch. Also, the number of electronic current sources needed to drive the ferrite cores is approximately

(continued on page 13)

Roster of Organizations in the Field of Computers and Automation

(Supplement, information as of Apr. 10, 1954)

The purpose of this Roster is to report organizations (all that are known to us) making or developing computing machinery, or systems, or data-handling equipment, or equipment for automatic control and materials handling. In addition, some organizations making components may be included in some issues of the Roster. Each Roster entry when it becomes complete contains: name of the organization, its address and telephone number, nature of its interest in the field, kinds of activity it engages in, main products in the field, approximate number of employees, year established, and a few comments and current news items. When we do not have complete information, we put down what we have.

We seek to make this Roster as useful and informative as possible, and plan to keep it up to date in each issue. We shall be grateful for any more information, or additions or corrections that any reader is able to send us.

Although we have tried to make the Roster complete and accurate, we assume no liability for any statements expressed or implied.

This listing is a supplement to the cumulative listing in the April issue of "Computers and Automation", vol. 2, no. 4.

Abbreviations

The key to the abbreviations follows:

<u>Size</u>

Ls Large size, over 500 employes
Ms Medium size, 50 to 500 employees
Ss Small size, under 50 employees (No. in parentheses is approx. no. of employees)

<u>When Established</u>

Le Long established organization (1922 or earlier)
Me Organization established a "medium" time ago (1923 to 1941)
Se Organization established a short time ago (1942 or later) (No. in parentheses is year of establishment)

<u>Interest in Computers and Automation</u>

Dc Digital computing machinery
Ac Analog computing machinery
Ic Incidental interests in computing machinery
Sc Servomechanisms
Cc Automatic control machinery
Mc Automatic materials handling machinery

<u>Activities</u>

Ma Manufacturing activity
Sa Selling activity
Ra Research and development
Ca Consulting
Ga Government activity
Pa Problem-solving
Ba Buying activity
(Used also in combinations, as in RMSa "research, manufacturing and selling activity")

*C This organization has kindly furnished us with information expressly for the purposes of the Roster and therefore our report is likely to be more complete and accurate than otherwise might be the case. (C for Checking)

*A This organization has placed an advertisement in this issue of COMPUTERS AND AUTOMATION. For more information, see their advertisement. (A for Advertisement)

ROSTER

Adalia Limited, Odeon Bldg., 20 Carlton St.East, Toronto, Ont., Canada / Empire 4-2361
Research and consulting services in the application, design, and construction of computers. Ss Se(1952) RCa

Andersen Laboratories, Inc., 39-C Talcott Road, West Hartford 10, Conn.
Solid ultrasonic delay lines, etc., for computer applications. Ss(30) Se(1950) Ic RMSa

Automatic Electric Co., 1033 West Van Buren St., Chicago, Ill. / Haymarket 1-4300 / *C, *A
Automatic electrical systems, telephone equipment, relays, stepping switches, etc., for computing machinery companies and independent telephone companies. Automatic control components. Ls(6000) Le(1892) ICc RMSa

Eckert-Mauchly Div., Remington Rand, Inc., 3747 Ridge Ave., Philadelphia, Pa., and elsewhere *C, *A
All purpose electronic digital computers. Univac Factronic System. Ls(600?) Se(1946) Dc RCMSa Also see Remington Rand, Inc.

Electro-Data Corporation, affiliate of Consolidated Engineering Corp., 717 North Lake Ave., Pasadena 6, Calif.
Electronic data-processing equipment for scientific, industrial and commercial applications. Se Dc RMSa

Engineering Research Associates, Div. of Remington Rand, Inc., 1907 Minnehaha Ave., St.Paul, Minn., and 510 18th St. South, Arlington, Va. *C, *A
Digital computers; ERA 1101 and 1103 electronic digital computers; the Logistics Computer. Magnetic storage systems, including magnetic heads, magnetic drums, etc. Shaft-

position indicator systems, self-recording accelerometers, analog magnetic recording systems, data-handling equipment, special purpose communications equipment, pulse transformers. Ls(750) Se(1946) Dc RMCPSa Also see Remington Rand, Inc.

Ferroxcube Corporation of America, 377 East Bridge St., Saugerties, N. Y. / Saugerties 1000 / *A
Ferrite core materials, including pot cores, cup cores, recording heads, and microminiature toroids with square hysteresis loop. Magnadur permanent magnet materials. Ms(100) Se Ic RMSa

Fischer and Porter Company, Hatboro, Pa.
Automatic instrumentation, including: measurement of a variable at the point of process; transmission of data, central collection, and display; data reduction systems using a mechanical digital converter (Digi-Coder); tabulated digital data output, etc. DACc RMSa

General Cybernetics Associates, P. O. Box 987, Beverly Hills, Calif. / Vermont 9-0544
Industrial automation, computers, instrumentation, communication, industrial electronics, etc. Ss(18) Se RMSCa

Hughes Research and Development Laboratories, Hughes Aircraft Co., Culver City, Calif. *A
Automatic data-handling systems. Industrial process control systems. Small, powerful, automatic electronic digital computer for airborne use. Fire-control equipment. Aircraft control. Navigation systems. Ls Me DAc RMSa

Intelligent Machines Research Corp., 134 South Wayne St., Arlington, Va. / Jackson 5-7226 / *C, *A
Devices for reading characters on paper, etc. Pattern interpretation equipment. Sensing mechanisms. Digital computer elements. Ss (10) Se(1951) Dc RCMSa

International Business Machines Corp., 590 Madison Ave., New York 22, N. Y. / Plaza 3-1900 / and elsewhere *C, *A
Punch card machines. Type 650, Magnetic Drum Calculator. IBM electronic Data Processing Machines, Type 701, Type 702, (magnetic tape, magnetic drum, electrostatic storage). Card Programmed Calculator. Electronic calculating punch Type 604. Data processing quipment. Process control equipment. Automatic Source Recording Equipment. Ls(42,000) Le(1911) Dc RMSa

The Kybernetes Corp., Division of Self-Winding Clock Co., 1100 Raymond Blvd., Newark 5, N. J./ Mitchell 2-0957 / *C
Devices employing high-speed television techniques for: making printed coded characters on paper with automatically translatable coding; reading printed code and translating it into signals; sorting media carrying printed codes, etc. Systems for multiplexing, scanning, telemetering, timing, television, etc. Ms(150) Le(1886, parent company) ICc RMSCa

Monrobot Corp., Morris Plains, N. J. / Morristown 4-7200 / *C, *A
Monrobot automatic electronic digital computers. Subsidiary of Monroe Calculating Machine Co. Ss(32) Se(1952) Dc RMSa

Raytheon Manufacturing Co., Waltham, Mass. / Waltham 5-5860 / *C, *A
Electronic digital computer systems for scientific applications (RAYDAC), and for general accounting and data-handling applications. Tape-handling mechanisms, magnetic heads, magnetic shift registers, and other computer components and subsystems. Computing service to analyze problems in applied mathematics, in engineering, and in industrial logistics by digital computer. Radar, fire control, microwave equipment, etc. Ls(20,000) Me(1925) DAc RMSa

J. B. Rea Co., Inc., 1723 Cloverfield Blvd., Santa Monica, Calif. / Exbrook 3-2701
Automatic control systems; computing facility; etc. ICc RMSCa

Sprague Electric Co., 377 Marshall Street, North Adams, Mass. *A
Capacitors: miniature, and low dielectric hysteresis loss, for computer applications. Standard capacitors; precision and power type resistors; pulse transformers; radio interference filters. Ls ?e Ic RMSa

Sylvania Electric Co., Radio and Television Div., 70 Forsyth St., Boston 15, Mass. / Kenmore 6-8900 / and elsewhere *C, *A
Electronic digital computers using printed circuit techniques. Subassemblies of diodes and triodes. Computer components. Ls (2200; this division 190) Le(1901; this division 1945) DAc RMSa

Visi-Record, Inc., Copiague, L. I., N. Y. / Amityville 4-4900
Filing systems for punched paper tape, etc. Ms(100) Ic RMSa

* ——— * ——— *

ROSTER OF AUTOMATIC COMPUTING SERVICES

(Supplement, information as of April 10, 1954)

The purpose of this roster is to report organizations (all that are known to us) offering automatic computing services and having at least one automatic computer. Each roster entry contains: name of the organization, its address / analog or digital computation provided / notes on equipment / any restrictions as to clients.

This edition is a supplement to the cumulative edition published in the February, 1954 issue of "Computers and Automation", vol. 3, no. 2, and the supplement in the April, 1954 issue, vol. 3, no. 4.

We shall be grateful for any additions or corrections that any reader is able to send us.

Some of the abbreviations are: A, analog; D, digital.

J B Rea Co, Inc, 1723 Cloverfield Blvd, Santa Monica, Calif / A, D, simulation / Electronic Associates analog computer, Beckman EASE analog computer, IBM card programmed calculator / unrestricted

FLIGHT SIMULATORS

I. From Alfred Pfanstiehl, Editor of of "Simulore", published by Flight Simulator Associates, Box 100, Tyndall Air Force Base, Florida.

Until you change the name of your very fine little publication so that digital computers are indicated, I would assume that information on analog computers would be welcomed. And since the several hundred full flight simulators now in constant use represent a new and big industry (simulators run about $500,000 each, for some models), perhaps it's time you schedule an article or two on this interesting application of computer techniques.

If you would like me to submit some material on this subject, let me know. I'll try to keep the writing fresh and direct; there's plenty of unclassified material worth digging into here. The problem of stability while making simultaneous, continuous, and interdependent solutions of the six aircraft rate equations, the heart of any flight simulator, is certainly interesting. The machines we have now work amazingly well, but of course there are studies being made into the actual response rates required, with an eye to giving digital methods a try, and such things. The Human Research boys are using simulators for some of their human engineering projects having to do with pilot limitations and training methods.

Give me an idea of what you think our readers would most appreciate. Engineering problems? Basic aerodynamics and derivation of the equations used? Tricky details added for realism? (Pilots do work up a sweat when confronted with emergency problems while "flying" a simulator. Most all clues other than actual g's are presented in the cockpit.)

I'll enclose a copy of our little magazine, Simulore. The next issue will be photo-offset, something like yours. FSA is a new organization set up to serve everyone in this new combined field of aerodynamics-electronics-computers.

We would be delighted to have one or several articles on the subject of flight simulators. Such an article should answer the usual questions of a person working in another part of the field of computers and automation, a person who has curiosity about something he does not already know, such as a flight simulator:

What are other names for it?
What are some examples of it?
How is it defined?
What is it like? what is it related to? what is it different from? what is it opposite to?
What are its properties? How is it constructed?
How is it used? How is it kept operating?
What is its origin? What is it likely to develop into?
How can it be of use to me?
Where besides present applications, could this kind of thing be useful?

We have not so far assumed in the pages of COMPUTERS AND AUTOMATION that every reader is happy with calculus, differential equations, and circuit diagrams. We are certain that many of our readers are mainly interested in ideas that have important and thought-provoking applications. We believe our readers are not disturbed by reading explanations of ideas they may already understand. The pages of other journals are available for more technical papers, particularly those that expound fairly complicated developments of a specialized nature, assuming a considerable background. — Editor

II. From "Simulore", published by Flight Simulator Associates, Box 100, Tyndall AFB, Florida, Feb. 15, 1954, No. 8

The world-wide Flight Simulator Symposium at Headquarters, U. S. Air Force, last month, gave each interested agency an opportunity to present its problems, make recommendations, and clarify policies. ... One of the commands using simulators stressed their importance from the viewpoint of economy. They maintained that simulators could be operated at approximately 10% of the cost of operating aircraft. The training program can be carried through with nearly 2/3 less aircraft and 1/3 fewer "party personnel". Additional advantages include the practicality of teaching emergency procedures, independence of weather conditions, and the possibilities of "crashing" without loss of life or equipment.

The need for processing engineering changes more quickly so that simulators should more nearly represent the aircraft in use was one of the more urgent problems presented. It was also considered desirable to purchase simulators at the same time as the aircraft, so that training could be started even prior to the delivery of the aircraft. ...

FLIGHT SIMULATORS

Flight Simulator Associates is growing rapidly. Membership now is up to about 150, with members at 20 locations. ...

Titles of articles: Flight Simulator Symposium called to Clarify Policies and Investigate Problems / Link F-89D Simulator Ready for Training at Moody Air Force Base / Real Preventive Maintenance -- The Key to Availability / FSA Membership Grows Towards Goal of 2000 / "Bootstrap" Sweep Circuit / Lucite Pot Covers Enable Easy Inspection for Slop / 15 Extra Seconds Required to Save Resistor's Accuracy / FSA Geography Shows Many Gaps to Be Filled

* ——— * ——— *

THE EDITOR'S NOTES

(continued from page 4)

Responsibility of a Scientist for the Application of His Discoveries. On April 1 many newspapers published a good deal of news about four recent tests of atomic bombs of the fusion type:

(1) November 1952, a test by the United States, fuel apparently tritium (a variety of hydrogen, very expensive), power measured as five million tons of TNT, that replaced an island in the Pacific by a crater 175 feet deep;

(2) August 1953, a test by the Soviet Union, fuel apparently lithium (cheap and plentiful), apparently of greater power;

(3) March 1, and (4) March 26, 1954, tests by the United States in the Pacific, fuel apparently lithium, power equivalent to 12 to 20 million tons of TNT.

For comparison, the atomic bomb (fission type) by which the United States in August 1945 during World War II killed 60,000 human beings in Hiroshima, Japan, had an explosive power of 20,000 tons of TNT -- a mere bauble compared with bombs now 1000 times as powerful.

It is well known among the computer fraternity that a good many recent problems being solved on automatic computers were urgent problems connected with atomic and nuclear physics. It is also well known among the automation fraternity that a good many recent urgent problems in automation were connected with the processes for handling materials associated with atomic and nuclear operations. So part of the credit and the responsibility for the successful construction of these new instruments for vast destruction belongs to scientists in the field of computers and automation, as well as scientists in the field of nuclear physics.

What then should we do now, as we come up to the brink of vast destruction, probably including ourselves?

There are two courses of action open to us. We can say that it is none of our business how our computer and automation discoveries are applied. We can say that the discussion of what they may be used for in this area belongs to other people, persons who have been delegated by society to consider these applications. We can say that the subject is political, the subject is controversial, the subject should not be discussed in this or that inappropriate environment.

Or we can decide that we are concerned with these applications. We can say that we are among the people who have to think about these instruments, and decide what to do about them. We can say that if we are concerned with the applications of computers and automation to the mail order business, the railroads, the construction of bridges, etc., then we are also concerned with their applications to the problem of survival of human beings and the survival of civilization. We can apply the principle the Allied powers enforced in the trials of Nazi war criminals in 1946 in Nuremberg, Germany, that there is a higher law than simple obedience to the orders and decisions of a military commander-in-chief. This second course of action seems more reasonable.

This magazine invites discussion of how the special skills of men in the field of computers and automation can be applied to the problem of the survival of human beings and the survival of civilization.

* ——— * ——— *

Forum:

REPORT ON THE AMERICAN MANAGEMENT ASSOCIATION CONFERENCE, FEB. 1954 — CORRECTION

From Frederic E. Pamp, Jr., American Management Association, New York, N. Y. :

... In your April, 1954 issue of COMPUTERS AND AUTOMATION is an article, written by Mr. Neil Macdonald, entitled "Processing Information Using a Common Machine Language". This is a write-up on our "Integrated Data Processing" Conference held February 25 and 26 at the Hotel Astor.

We have noted one error in this article: it states that "...the talks themselves are to be printed in the magazine 'Office Management'." This magazine, however, printed only excerpts of the speeches in their March and April issues. The American Management Association will reprint these speeches, and they should be available about the middle of April.

AUTONOMY AND SELF-REPAIR FOR COMPUTERS: A SYMPOSIUM

Elliot L. Gruenberg
The W.L. Maxson Corporation, New York, N.Y.

On Thursday, March 25, 1954, in the Kingsbridge Armory, the Bronx, New York, something new in the way of engineering discussions occurred. This was a symposium organized by the Professional Group on Electronic Computers of the Institute of Radio Engineers, in order to discuss two general topics:

(1) Can Computers be Made More Autonomous?
(2) Can Computers be Made to Repair Themselves?

Here engineers and scientists had a clear opportunity to remove themselves from their day-to-day problems and think ahead. Even the organization of the meeting was unusual. The chairman, G M Amdahl, sat at a table elevated high above the speakers. The speakers, who were really supposed to be discussion leaders, sat at 8 tables, at each of which other people who might wish to participate in the discussion could also sit. The speakers were all well known in the computer field: Claude Shannon of Bell Telephone Laboratories; Nathaniel Rochester of International Business Machines Corp.; W.B. Huskey of the Univ. of California at Los Angeles; John W. Mauchly of Remington Rand; Louis N. Ridenour of International Telemeter Corp.; E.F. Moore of Bell Telephone Laboratories; A.L. Samuel of IBM; and J.B. Wiesner of Mass. Inst. of Technology. Here indeed was a chance to find out where computer development is going.

The discussion was started by Mr.Shannon, who considered how to make machines self repairing. There are two ways to overcome failures: (1) improve component reliability; and (2) improve the circuits so that operations go on anyway. Bifurcated relay contacts are an example of an attempt in the second direction. The brain affords another example. The neurons die and are never replaced. Many dead ones must exist in the brain of even a genius and yet effective operations go on for years and for billions upon billions of operations. Even with large numbers of dead neurons the brain never gives out complete nonsense, such as computers do when components break down.

Mr. Rochester continued on the topic of self repair. He projected some trends. Computers now contain 10^4 elements. He estimates that 30 years hence machines will contain 10^8 elements and be 10 times as reliable. Thus components must be expected to have an average life of 2,000,000 hours although failures under these conditions would still occur about once every 10 days. Two possible solutions to the self-repair problem exist: have the machine find its own troubles and have maintenance men replace it; or have one machine repair another. However, what happens if one machine A fails in such a way as to make it indicate to the other machine B that B and not A is in need of repair?

Dr. Huskey commented on making machines more autonomous. The machines can and should be refined to the point where they can accept written formulas directly. Eventually computers should be able to work directly on simplifying mathematical formulas and logical equations themselves.

Dr. Mauchly felt that computers could be made more autonomous by having the computer organize its own data. Automatic programming is a step in this direction. He questioned whether maximum use is being made of the speed of the present machines. They can control 10^8 bits of data each of which, according to Türing, can be considered a switch. Compare this to 10^{10} cells in the brain. He was convinced that a machine could be devised to perform thinking as defined in any conceivable fashion.

Mr. Moore said that any machine in order to perform repair must be able to <u>judge</u> whether the repairing really needed be done.

Dr. Ridenour spoke on machines having autonomy. He noted two differences between the nervous system of the higher animals and present large data-processing machines. One is that nature uses tremendous redundancy in its designs. Second, the machines do not incorporate a retentive memory and literally have to be born again for each new job.

Dr. Samuels pointed out that a large step toward making machines more autonomous is to design machines capable of understanding human language. Another interesting point he made is that the proportion of redundancy in processed information that is required to insure accuracy decreases as the amount of information increases. Referring to this observation, Mr. Wiesner declared that this bodes well for the future, since a redundancy of 10 is much less annoying to a man who designs a machine of 10^9 elements than to one who designs present machines of 10^4 elements.

In the discussion that followed several interesting comments were made. Dr. Grosch of General Electric remarked that plenty was wrong with present machines without worrying about

autonomy, and that among other things better input-output systems are needed. Someone else remarked that no wonder computer engineers want to have machines repair themselves, for they break down very often and the troubles are very hard to find. Dr. Forrester of MIT stated that self repair must come in small steps, that the present system of marginal checking will be supplemented by automatic re-centering of operating levels, and similar steps. Other speakers accented the economic problem. Dr. Valley raised the question, "To what degree of excellence do you want to keep computers in repair?" Prof. Fano's view was that computers won't die, they will gradually fade away. Alluding to Von Neumann's work on evolving more perfect computer elements from less perfect elements, Dr. Shannon pointed out that bringing present components up to the reliability of the human brain would require improvement by a factor of 20,000.

In regard to the physical organization of the conference, in my opinion it was not as successful as could be hoped. The speakers did not function as discussion leaders, since there were 8 speeches within two hours, and that left little time for discussion from the floor. But the separate table arrangement did give people a better opportunity to meet the speakers after the meeting and some lively discussions with them.

None of the scientists present took the view that machines should autonomously do problem solving or problem finding, although it has been argued that these are legitimate future objectives of computing machines. (See "Reflective Thinking in Machines", by Elliot L. Gruenberg in "Computers and Automation", Feb. 1954.) The speakers apparently thought more in terms of a slave machine that ought only to take orders, give no trouble, and keep itself in good repair. They avoided committing themselves on the subject of thinking in machines, but seemed content to hope that when and if thinking did occur in machines, they would recognize it. Until such time they intended to go on making machines that imitated some of the reasoning behavior of human beings and let it go at that.

* ——— * ——— *

FERRITE MEMORY DEVICES
(continued from page 7)

equal to twice the square root of the total number of bits in each of the memory planes. For example, a memory plane capable of storing 16 binary digits requires 8 driving circuits, while a memory plane which can store 16,384 binary digits only requires 256 driving circuits.

With reference to overall reliability and life expectancy of a ferrite magnetic memory system, there is no known deterioration with age and usage.

* ——— * ——— *

Forum:

WHO'S WHO IN COMPUTERS AND AUTOMATION -- WAYNE UNIVERSITY, DETROIT

(Supplement, information as of March 4, 1954)

The following list consists of persons interested in computers or automation who are at the Computation Laboratory at Wayne University, Detroit, Mich. On March 12 we received an envelope from them containing all twenty Who's Who entries, each entry filled in on a form they had dittoed.

Each entry below contains: name / title / interests / year of birth, college or last school (background), year of entering the field, occupation. "-" denotes omission. The letters A, B, C, D, E, M, P, S stand for main interests "Applications, Business, Construction, Design, Electronics, Mathematics, Programming, Sales", respectively, as provided for in the Who's Who entry blank (see page 29 in the back).

We shall be glad to publish other groups of entries.

Blowers, Richard C / res techn / CDEM / '27, Wayne Univ, '53, techn
Dixon, Wesley C / res assoc / ADMP / '25, Univ of Conn, '50, analyst prgrmr
Harrison, Hershel / stud asst / MP / '31, Wayne Univ, '54, coder
Heizer, John R / res techn / ACDEMP / '30, Wayne Univ, '54, techn
Helm, Carl E / res assoc / AM, psychological data processing & res / '27, Wayne Univ, '53, prgrmr
Jackson, Thomas R / res assoc / AMP / '27, Wayne Univ, '52, mathn
Jacobson, Arvid W / dir of lab / ABMP / '04, Univ Mich, '49, teacher
Kamm, Vernon C / res assoc / ADE, res in components, log sys, etc / '29, Univ of Ill, '52, engr
Kampe, Elza / res assoc / MP / '16, Univ Mich, '54, res assoc
Kord, Harry / res assoc / MP, theoretical physics / '18, Grad Schl of Wayne Univ, '53, coder and analyzer
Langdon, Lyle R / res assoc / MP / '98, Univ Mich, '54, mathn
Lenss, Alise / res assoc / MP, theor physics / '19, Wayne Univ, BA Univ Latvia, '53, mathn
Licht, Gerald L / res assoc / ABDE / '27, Wayne Univ, '53, engr

(continued on page 28)

A GLOSSARY OF COMPUTER TERMINOLOGY

Grace M. Hopper,
Programming Research Section, Remington Rand, Inc., Philadelphia

Note by the Author: This glossary is not considered to be complete or final. It borrows freely from available printed material, particularly the "IRE Standard on Electronic Computers: Definitions of Terms", and the "Glossary" published by "Computers and Automation". This glossary has been assembled from the point of view of applications not that of engineering. It is mainly a UNIVAC vocabulary, although some attempt has been made to make it applicable to all computers. It is our earnest plea that we receive comments, suggestions, and criticisms.

Note by the Editor: In editing this glossary for publication, some changes may have been made with which the author may not be in full agreement. However, revised and improved versions of the glossary are anticipated.

GLOSSARY

access time, latency time -- the time interval (1) between the instant at which information is called for from storage and the instant at which it is delivered; (2) between the instant at which information is ready for storage and the instant at which it is stored

minimum access routine -- a specific routine so coded that the access time required to obtain and store information has been minimized

acceptable -- the term "acceptable to" applies to transfers from one storage medium to another in which the information transferred is meaningful to the second medium

accumulator -- a device containing a register which stores a quantity; when a second quantity is delivered to the device, it forms the sum of the quantity standing in the register and the second quantity, and stores the result in the register. Frequently, the accumulator performs other operations upon a quantity in the register such as sensing, shifting, extracting, complementing, etc.

accuracy -- correctness or freedom from error; the term contrasts with precision; for example, a four-place table, correctly computed, is accurate; while a six-place table containing an error is more precise but less accurate

adder -- a device capable of forming the algebraic sum of two quantities delivered to it

address -- a set of characters forming a label, name, or number which designates a register, a location, or a device where information is stored

single-address instruction consists of a coded representation of an operation to be performed and of the address of an operand

multi-address instruction consists of a coded representation of an operation to be performed and of the addresses of two or more operands

arithmetic operation -- the operations in which numerical quantities form the elements of the calculation, including the fundamental operations of arithmetic; add, subtract, multiply and divide.

arithmetic unit -- that portion of the hardware of an automatic digital computer where arithmetical and logical operations are performed on elements of information

base -- number base -- see notation

bit -- binary digit (colloquial)

block -- a group of consecutive words considered or transported as a unit, particularly with reference to input and output

input block -- a segment of the internal storage reserved for receiving and processing input data

output block -- a segment of the internal storage reserved for receiving output data

blockette -- a subgroup of consecutive words within a block; an integral number of blockettes are contained in a block

break-point -- a point in a routine at which a special instruction is inserted which, if desired, will cause the computer to stop

buss -- a means by which information is transferred

call-word -- word identifying a subroutine and carrying information concerning parameters to be imposed on the subroutine or concerning the operands

carry (noun) -- (1) a condition occurring during addition when the sum of two digits in the same column equals or exceeds the number base; or (2) the digit to be added to the next higher column; or (3) the process of forwarding the carry digit

channel -- (1) a recirculation path in acoustic delay line storage containing a fixed number of words in series; (2) a path in magnetic storage (drum or tape) controlled by a set of reading, writing, and erasing heads and storing information in serial form

character -- one of a set of elementary symbols which may be arranged in ordered aggregates to express information; these symbols may include the decimal digits 0 through 9, the letters A through Z, punctuation symbols, typewriter symbols, and any other single symbols which a computer may read, store or write

check -- see below

automatic check -- provision, constructed in hardware, for verifying information transmitted, manipulated, or stored by any unit or device of the computer

duplication check -- duplication of hardware and continuing comparison of results to insure accuracy

redundant check -- use of summation of bits and redundant bits (check digits) to insure accuracy

mathematical check -- a check of an operation making use of the mathematical properties of the operation; e.g., checking the multiplication A x B=C by comparing it with B x A=C

check digit -- one or more digits carried in a symbol or a word dependent upon the remaining digits in such a fashion that if a single error occurs (excluding compensating errors) a check will fail, and the error will be reported

clear (verb) -- to replace information in a storage device by zero as expressed by the number system involved

code (n.) -- (1) a system of symbols and of the rules for their use in representing information; (2) a language

pulse code -- the system of binary representation of characters

computer code -- either "operation code" or "instruction code", which see

operation code -- the code representing the operations built into the hardware of the computer

instruction code -- that part of an instruction designating the operation to be performed

pseudo-code -- an arbitrary code, independent of the hardware of the computer, which must be translated into computer code in order to control the computer

compiler code -- a code acceptable to a "compiler", which see

interpreter code -- a code acceptable to an "interpreter", which see

code (vb.) -- (1) to express problems in a particular system of symbols, using certain rules; (2) (colloquial) to write problems in a language acceptable to a computer

coding -- the list in computer code of the successive computer operations required to carry out a given routine or subroutine

specific coding -- coding in which all addresses refer to specific registers and locations

relative coding -- coding in which all addresses refer to an arbitrarily selected position, or in which all addresses are represented symbolically

"own-coding" -- (colloquial) a specialized subroutine not stored in the permanent library of subroutines

collate -- to merge and combine two or more similarly ordered sets of items to produce a new similarly ordered set, not necessarily of the same item-size, containing information from the original sets

column -- the character or digit position in a unit of information

comparator -- a device for making a comparison and, frequently in computers, for acting on the result of the comparison

compare -- to examine the representation of,

for the purpose of discovering identity or relative magnitude

comparison -- the act of comparing and, in computers, usually acting on the result of the comparison. The common forms are comparison of two words for identity, comparison of two words for relative magnitude, and comparison of sign with positive zero. Comparisons may operate on either character or binary notation

compile -- to produce a specific routine for a particular problem by the following process: (1) decoding an element of information expressed in pseudo-code; (2) selecting or generating the required subroutine; (3) transforming the subroutine into specific coding and entering it as an element of the problem routine; (4) maintaining a record of the subroutines used and their position in the problem routine; and (5) continuing to the next element of information

compiler -- a routine which "compiles", which see

complement -- a quantity which is derived from a given computer quantity by either of the following rules, where n is the base or radix of the quantity: (a) in the case of "Complement on n"; subtract each digit of the given quantity from n-1, add unity to the least significant digit, and perform all resultant carries; (b) in the case of "complement on (n-1)"; subtract each digit of the given quantity from n-1

computer -- any device capable of accepting information, applying meaningful processes to the information, and supplying the results of these processes in acceptable form

contents -- the symbol "( )" is used to indicate "the contents of"; for example, (m) indicates the contents of storage location m; (A) indicates the contents of register A ; (T_2) indicates the contents of the tape on input-output unit two

control (vb.) -- to direct the sequence of execution of the instructions to a computer

control unit -- that portion of the hardware of an automatic digital computer which directs the sequence of operations, interprets the coded instructions, and initiates the proper signals to the computer circuits to execute the instructions

counter -- a device which permits integers to be altered positively or negatively by unity, or by an arbitrary integer

program counter, cycle counter, control counter -- special counters constructed of hardware and contained in the control unit

d-c dump -- (colloquial) the condition in the computer resulting when direct current power is withdrawn from the computer; i.e., loss of internal and circulating storage

debug (vb.) -- (colloquial) to remove a malfunction from a computer or an error from a routine

digit -- one of the symbols 0, 1, ..., 9 and sometimes also letters, used to designate each of the n-1 quantities smaller than the base n of a scale of numbering

check digit -- see "check"

decimal digit -- one of the symbols 0, 1, ... 9; a digit in the decimal scale of notation

coded decimal digits -- decimal digits which are expressed by a pattern of four or more ones and zeros

binary digit -- one of the symbols zero (0) or one (1); a digit in the binary scale of notation

diagram -- in computer programming, a schematic representation of a sequence of subroutines designed to solve a problem

double-precision (adj.) -- having twice as many digits as the quantities normally handled in a specific computer

edit -- in computer programming, to rearrange information; editing may involve the deletion of unwanted data, the selection of pertinent data, the insertion of invariant symbols such as page numbers and typewriter characters, and the application of standard processes such as zero-suppression

erase -- to replace information in a storage device by binary zeros; i.e., to delete all signals

error -- the amount of loss of precision in a quantity; the difference between an accurate quantity and its calculated approximation

truncation error -- the error resulting from the approximation of operations in the infinitesimal calculus by operations in the calculus of finite differences

round-off error -- the error resulting from deleting the less significant digits of a quantity and applying some rule of correction to the part retained.

extract -- (1) to replace the contents of spec-

ific columns of a word (as indicated by an extractor) by the contents of the corresponding columns of another word; (2) to perform logical multiplication

field -- a set of one or more characters (not necessarily all lying in the same word) which is treated as a whole; a unit of information

card field -- a set of card columns fixed as to number and position into which the same unit of information is regularly entered

floating point -- the operation of expressing all numerical quantities as quantities lying within a pre-determined range and multiplied by a power of the number base. Thus: "Floating Binary", $X = \pm p \times 2^j$, $0 \leq p < 1$; or "Floating Decimal", $X = \pm p \times 10^j$, $0 \leq p < 1$, or $X = \pm p \times 10^j$, $p = 0$ or $1 \leq p < 10$

flow chart -- a graphical representation of a sequence of operations, where the symbols employed represent the operations "compute, substitute, decide, transfer control, transfer data"

function table -- a device constructed of hardware or a routine which can either decode multiple inputs into a single output, or encode a single input into multiple outputs

generate -- in programming operations, to produce coding by assembling and modifying primitive elements; similar to generation of line by point, plane by line, etc

hardware -- the mechanical, magnetic, electrical, and electronic devices from which a computer is constructed

hold -- to retain the information contained in one storage device after copying it into a second storage device

information -- (1) a set of marks or an arrangement of hardware that has been assigned meaning; (2) any facts or data

input -- information transferred from secondary or external storage into the internal storage of the computer

instruction -- in computer programming, a set of characters which, as a unit, causes a computer to perform one of its operations or a set of symbols which directs the computer to take a given action. Instructions may contain one or more addresses according to the number of references to operands in storage contained in the instruction. (Usage: the term instruction is preferred by us to the terms "command" and "order"; "command" is reserved for electronic signals; "order" is reserved for such phrases as "the order of the characters", etc

interpret -- in computer programming, to produce the desired solution of a particular problem by: (1) decoding an element of information expressed in pseudo-code; (2) selecting the required subroutines; (3) carrying out the required operation by means of the subroutine selected; and (4) continuing to the next element of information

item -- a set of one or more fields containing related information

library -- in computer programming, an ordered set or collection of standard and fully tested routines and subroutines, by which problems and parts of problems can be solved, or stored in a form acceptable to the computer

logical operations -- the operations in which logical quantities (yes-no decisions, quantities expressed as zeros and ones) form the elements of calculation or operation, including comparisons, decisions, and extractions

merge -- to produce a single set of items, ordered according to a rule, from two or more sets previously ordered according to the same rule

notation -- a manner of writing quantities, i.e., quantities written on the base $\underline{n}$ or in the scale of $\underline{n}$ are said to be written in the "$\underline{n}$-ary" notation; the positions of the digits designate the powers of the base $\underline{n}$.. If $\underline{n}$ is 2, "$\underline{n}$-ary" becomes "binary"; if $\underline{n}$ is 10, "$\underline{n}$-ary" becomes "decimal"

binary notation -- the writing of quantities in the scale of two

decimal notation -- the writing of quantities in the scale of ten

operation -- in computers: (1) the set of computer functions required to accomplish a mathematical or logical action, executed under the direction of a subroutine; (2) a defined action; (3) an arithmetical, logical, or transferal unit of a problem

computer operation -- the activity resulting from an instruction

complete operation -- an operation which includes (1) obtaining all operands from storage, (2) performing the operation, (3) returning resulting operands to storage

operation number -- a number indicating the position of an operation in the sequence forming a specific routine

output -- information transferred from the internal storage of a computer to secondary or external storage

over-capacity -- see "overflow"

overflow -- in an arithmetical operation, the generation of a quantity beyond the capacity of the unit; specifically, in addition, generation of a sum greater than the capacity of the sum register; in division, generation of a quotient greater than the capacity of the quotient register

parameter -- a quantity to which arbitrary values may be assigned; used in non-mathematical subroutines, such as input-output generators, to specify item-size, decimal-point, block arrangement, etc

point -- in a scale of notation, the position (usually designated with a dot) that marks the separation between positive and negative powers of the number base

precision -- the degree of exactness with which a quantity is stated; a relative term often based on the number of significant digits in a measurement. See "accuracy"

quantity -- a positive or negative real number in the mathematical sense. (Usage: the term "quantity" is preferred by us to the term "number" in referring to numeric data; the term "number" is reserved for "the number of digits", "the number of operations", etc.)

random access -- access to storage under conditions where there is no rule for predetermining the position from which the next item of information is to be obtained

random number -- a number formed by a set of digits selected from a random sequence of digits. A sequence of digits is random when it is constructed by a process under which each successive digit is equally likely to be any of the n digits to the base n

read (vb.) -- (1) to copy, usually from one form of storage to another; (2) to sense the meaning of an arrangement of hardware representing information

real-time operation -- paralleling data-processing to a physical process in such a fashion that the results of the data-processing are useful to the physical operation

on-line operation -- see "real-time operation

simulation -- see "real-time operation"

record (vb.) -- to copy or set down in reusable form for future reference

reference record -- one of the outputs of a compiler; it consists of a list of the operations and their position in the final specific routine; it also contains information describing the segmentation and storage allocation of the routine

register -- the hardware for storing one or more words; registers are frequently devices requiring a very small amount of access time

re-run routine -- a routine designed to be used in the wake of a computer malfunction to reconstitute a routine from the last previous rerun point

rerun point -- that stage of a complete run at which all information pertinent to the running of the routine is available to either the routine itself or to a re-run routine in order that a run may be reconstituted

rewind -- to return a magnetic tape to its beginning

routine -- an explicit set of instructions coded in computer language and arranged in proper sequence to instruct the computer to perform a desired operation or series of operations. (Usage: this term is preferred by us to "program")

subroutine -- (1) the set of instructions necessary to instruct the computer to carry out a well-defined mathematical or logical operation; (2) a subunit of a routine, usually stored in relative coding

specific routine -- a routine expressed in specific computer coding designed to solve a particular mathematical, logical, or data-handling problem

general routine -- a routine expressed in computer coding designed to solve a class of problems and a specific problem when appropriate parametric values are supplied

diagnostic routine -- a specific routine designed to locate a malfunction, either in other routines or in the computer

run -- one routine or several routines automatically linked so that they form an operating unit during which manual manipulations are not required of the computer operator

segment -- a part of a complete specific rou-

(continued on page 20)

PATENTS

Hans Schroeder,
Milwaukee, Wisconsin

The following is a compilation of patents pertaining to computers and associated equipment from the Official Gazette of the United States Patent Office, dates of issue as indicated. Each entry consists of: patent number / inventor(s) / assignee / invention.

<u>February 23, 1954</u>: 2,670,134 / E. Lakatos, Summit, N J / Bell Tel Labs, Inc, New York, N Y / Analog computer for positioning guns

2,670,456 / A F Naylor, Haddonfield, and A M Spielberg, Camden, N J / RCA, Camden, N J / Switching system for dual-speed electric servo-mechanism.

<u>March 2, 1954</u>: (No applicable patents)

<u>March 9, 1954</u>: 2,671,607 / F C Williams, Timperly, and T. Kilburn, Davyhulme, Manchester, England / Natl Research Development Corp, London, England / Binary electronic computer including a cathode-ray storage tube.

2,671,608 / C J Hirsch, Douglaston, N Y / Hazeltine Research, Inc, Chicago, Ill / Electrical computer for solving equations with several unknowns.

2,671,609 / H R Davidson, Easton, Pa / General Aniline and Film Corp, New York, N Y / Mechanical analog computer for determining the reflectance of a mixture of colorants.

2,671,610 / J H Sweer, Collingwood, N J / RCA / Integrator using servomotors.

2,671,611 / E L Vibbard, Jackson Heights, N Y / Bell Tel Labs, Inc, New York, N Y / Sequence control circuit for computer.

2,671,613 / W W Hansen, Garden City, N Y / Sperry Corp / Electrical predicting gun directing system.

<u>March 16, 1954</u>: 2,672,283 / B L Havens, Cresskill, N J / Internl Bus Mach Corp, New York, N Y / Electronic binary multiplier.

2,672,590 / H J McSkimin, Basking Ridge, N J / Bell Tel Labs, Inc, New York, N Y / Delay line using reflections within a solid transmitting medium.

(continued from page 18)

tine, which can be entirely stored in the internal storage and contains the coding necessary to automatically call in and transfer control to other segments. Routines which exceed internal storage capacity are automatically divided into segments by the compiler

sentinel -- a symbol marking the beginning or the end of some element of information such as a field, item, block, tape, etc

shift (vb.) -- to move the characters of a unit of information columnwise right or left

arithmetic shift -- to multiply or divide a quantity by a power of the base of notation

sort (vb.) -- to arrange items of information according to rules dependent upon a key or field contained by the items

storage -- any device into which units of information can be transferred, which will hold this information, and from which the information can be obtained at a later time. (Usage: this term is preferred by us to "memory", a word with biological connotation, and to "store", a term commonly used in England)

internal storage -- storage facilities forming an integral physical part of the computer and directly controlled by the computer

register -- a storage device, usually a part of the arithmetic unit, storing one or more computer words

location -- a storage position in the bulk internal storage, storing one computer word

secondary storage -- storage facilities not forming an integral part of the computer but directly controlled by and linked to the computer

external storage -- (1) storage facilities separate from the computer itself but holding information in a form acceptable to the computer (magnetic tape, punched cards, etc.); (2) units which hold information in the form of arrangements of physical elements, hardware, or equipment

circulating storage -- a storage device consisting of a means for delaying information and for regenerating and reinserting the information into the delaying means

buffer storage -- (1) facilities linked to an input device in which information is assembled from external or secondary storage and stored ready for transfer to internal storage; (2) facilities linked to an output device into which information is transmitted from internal storage and held for transfer to secondary or external storage. Computation continues while transfers between buffer storage and secondary or external storage or vice versa take place

working storage -- a portion of the internal storage reserved for intermediate and partial results arising during computation

storage operation -- one of the operations of reading, transferring, storing, or writing information

store (vb.) -- to transfer an element of information to a device from which the unaltered information can be obtained at a later time

subroutine -- the set of instructions necessary to instruct the computer to carry out a well-defined mathematical or logical operation; a subunit of a routine, usually stored in relative coding

closed subroutine -- a subroutine not stored in its proper place in the linear operational sequence, but stored away from the routine which refers to it. Such a subroutine is entered in the problem routine by a transfer of control operation and provision is made to return control to the main routine at the end of the operation

open subroutine -- a subroutine which must be inserted directly as a "copy" into a larger routine. Hence, for each successive application of an "open subroutine" another "copy" must be inserted

static subroutine -- a subroutine which requires only the relative addresses of the operands and their insertion and its transformation from relative to specific coding

dynamic subroutine -- a subroutine which requires not only the relative addresses of the operands, their insertion and its transformation into specific coding, but also certain other information, parametric in nature, such as decimal-point position or item size, from which the relatively coded routine is derived

specific subroutine -- a subroutine, usually in relative coding, designed for and inserted into a specific problem; see "own-coding"

(continued on page 22)

PUBLICATIONS: COMPUTERS, ROBOTS, SYMBOLIC LOGIC, ETC.

BRIEF — FILLED WITH INFORMATION — CLEAR — SCIENTIFIC

P 22: TIC-TAC-TOE PLAYING MACHINE PLANS. Report ready about May 5. Plans, circuits, parts list, etc., for constructing an automatic machine which will play the game of ordinary tic-tac-toe with a human being, on a board with nine squares. Second edition, following construction.....$4.00

P 10: THE CONSTRUCTION OF LIVING ROBOTS. Report. Discusses the properties of robots and of living beings. Outlines how to construct robots made out of hardware which will have the essential properties of living beings. Gives circuit diagrams.................................$1.00

P 6: CONSTRUCTING ELECTRIC BRAINS. Reprint of the series of thirteen articles by E. C. Berkeley and Robert A. Jensen published in "Radio Electronics", Oct. 1950 to Oct. 1951. Explains simply how an automatic computer is constructed; how to make it add, subtract, multiply, divide, and solve problems automatically, using relays or electronic tubes or other devices. Contains many examples of circuits......................$5.50

P 13: A SYMBOLIC ANALYSIS OF RELAY AND SWITCHING CIRCUITS. Reprint of the classic paper by Claude E. Shannon, mathematician and scientist, published 1938 in the Transactions of the AIEE, and long out of print. The first application of Boolean algebra to relays and other on-off circuit elements...........................$0.60

Edmund C. Berkeley and Associates
815 Washington St., R90, Newtonville 60, Mass.

Please send me publications circled
P1 P10 P13 P22
and ( ) your announcement of courses offered by mail. Returnable in seven days for full refund if not satisfactory. I enclose $_______ in full payment. (Add 10¢ per item to cover cost of handling and mailing.)

My name and address are attached.

(continued from page 20)

substitute (vb.) -- to replace an element of information by some other element of information

system -- an assembly of components united by some form of regulated interaction; an organized whole

number system -- see "notation"

tank -- (colloquial) a unit of delay-line storage, usually of mercury and operating acoustically, containing a set of channels each forming a separate recirculation path

transfer (n.) -- the copying of information from one position in storage to another

serial transfer -- a system of data transfer in which the characters of a word are transferred in sequence over a single line

parallel transfer -- a system of data transfer in which all the characters of a word are transferred simultaneously over a set of lines

transfer (vb.) -- to copy information from one position in storage to another without altering the information; in general, information is erased only when new information is transferred into a storage position

-- to copy from one storage device to another

trouble-shoot -- (colloquial) to locate the cause of computer or routine malfunctioning; the same as "de-bug"

transfer of control -- an instruction or signal which conditionally or unconditionally specifies the location of the next instruction and directs the computer to that instruction

transform (vb.) -- to change in structure or composition without altering the meaning or value

translate -- to change information from one language to another without significantly affecting the meaning

transport (vb.) -- to convey as a whole from one storage device to another

verify -- to automatically check a transfer of data, especially a transfer of data by a manual process into computer language

word -- a set of characters fixed in number which is treated by the computer circuits as a unit and transported as such

word time -- the time required to transport one word (serially) from one zero-access register to another

write -- (1) to copy, usually from internal to external storage; (2) to transfer elements of information to an output medium; (3) to record information in a register, location, or other storage device or medium

* ------------------------ * ------------------------ *

Forum:

CONTROVERSY -- A COMMENT

From Alan Bloch, New York, N. Y.:

I want to register strong approval of your remarks on controversy in the April issue of COMPUTERS AND AUTOMATION.

It may be contended, of course, that the subject of controversy has no direct relation to the field of computing. I disagree: I think that contention is unsound. Rigid orthodoxy, it seems to me, is nothing more than the intellectual's version of anti-intellectualism; and everybody who thinks has a stake in fighting it.

Although the computing field is presently split -- analog versus digital -- I see no chance of a division between liberal and conservative computers. In spite of this, a statement of the desirability of intellectual and technical freedom is always in order.

Forum:

"INTRODUCING COMPUTERS TO BEGINNERS" BY GEOFFREY ASHE -- A COMMENT

From W. S. Howard, Vancouver, Canada:

Please mail all available back copies of "The Computing Machinery Field" and/or "Computers and Automation" to and including the October, 1953 issue of the latter. Kindly include your invoice ...

We are much in accord with articles such as that written by Mr. Ashe in the March, 1954 edition. Despite the possibility of being considered vulgar it somehow reminds me of our old family doctor who summarized a rather complete physical examination in this manner:

"I could diagnose your present distress in precise medical terms which would create additional anxiety and thereby increase your suffering. Instead, let me say you have nothing more than a good old-fashioned belly-ache."

BOOKS AND OTHER PUBLICATIONS

(List 8: COMPUTERS AND AUTOMATION, vol. 3, no. 5, May, 1954)

This is a list of books, articles, periodicals, and other publications which have a significant relation to computers or automation, and which have come to our attention. We shall be glad to report other information in future lists, if a review copy is sent to us. The plan of each entry is: author or editor / title / publisher or issuer / date, publication process, number of pages, price or its equivalent / a few comments. If you write to a publisher or issuer, we would appreciate your mentioning the listing in COMPUTERS AND AUTOMATION.

Akins, G. F. / "Principles of Automatic Control", Parts I, II and III in "ISA Journal" vol. 1, no. 1-3, Jan.-Mar. 1954 / Instrument Society of America, 1319 Allegheny Avenue, Pittsburgh 33, Pa. / 1954, printed, $5 per year

A fascinating account, with an excellent example, of the reasons for having automatic control, the design of an automatic controller, and the application of a controller to a process. Is the complete text of the material used in the ISA's training film. Should not be missed by someone desiring to become informed about automatic control.

Association for Computing Machinery / Journal of the Association for Computing Machinery, vol. 1, no. 1, January 1954 / Association for Computing Machinery, 2 East 63 St., New York 21, N. Y. / 1954, photooffset, 55 pp, $5.00 a year for members, $10 a year for non-members, $2.50 for single copies

Contains seven papers: S. B. Williams, "The Association for Computing Machinery"; J. W. Backus, "The IBM 701 Speedcoding System"; R. T. Wiseman, "Life Insurance Premium Billing and Combined Operations by Electronic Equipment"; F. E. Hamilton and E. C. Kubie, "The IBM Magnetic Drum Calculator Type 650"; H. Jacobs, Jr., "Equipment Reliability as Applied to Analogue Computers"; C. M. Edwards, "Survey of Analog Multiplication Schemes"; R. Perley, "Automatic Strain-Gage and Thermocouple Recording on Punched Cards". Also contains a page of "News and Reports"; and the Office of Naval Research Digital Computer Newsletter, vol. 6, no. 1, reprinted on pages 47 to 55.

Clippinger, R. F., B. Dimsdale, and J. H. Levin / "Automatic Digital Computers in Industrial Research", Parts I, II and III / Raytheon Manufacturing Co., Waltham, Mass. / 1954, dittoed, approx 90 pp, free

Examines cost factors in handling large scale problems through the use of a digital computer, and the costs and problems in establishing and operating a computing installation. A thorough and practical discussion.

Clutterham, David R. / Description of Code Checking Routines, University of Illinois Digital Computer / Univ. of Illinois Digital Computer Laboratory, Urbana, Ill. / June 8, 1953, dittoed, 6 pp, limited distribution

Technical, in that it requires knowledge of the "Illiac" computer; but suggests some ideas.

Diebold, John / Automation -- The New Technology / Harvard Business Review, Soldiers Field, Boston 63, Mass. / Nov.-Dec. 1953, photooffset reprint, 9 pp, $1.00

Discusses: feedback control; electronic controls for special automation processes; redesigning of processes, machines, and products; limiting factors on automation; etc. Nontechnical.

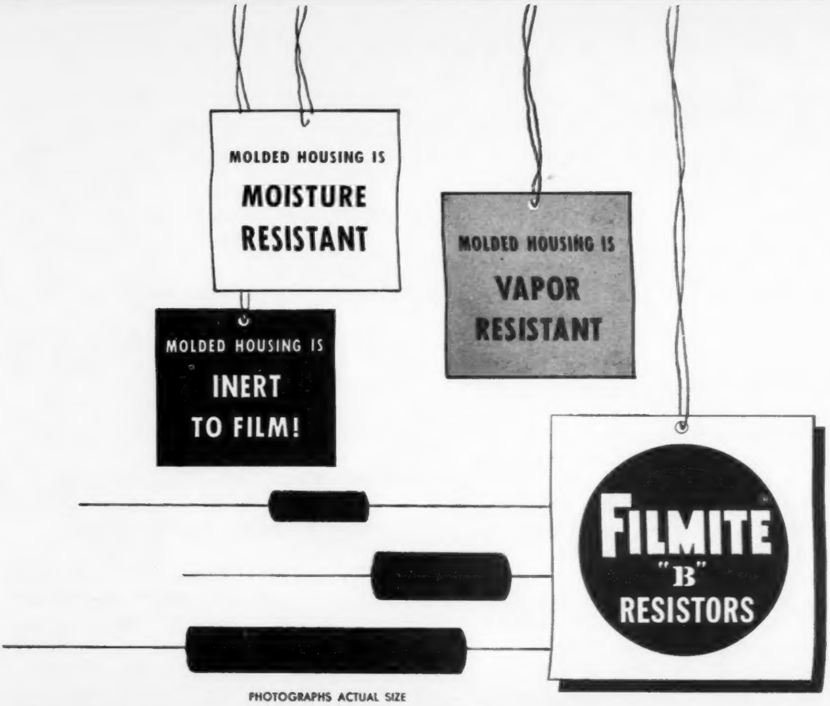
Erickson, R. S. / The Logistics Computer / Engineering Research Associates Division of Remington Rand, Inc., 1902 West Minnehaha Ave., St. Paul, Minn. / 1953, photooffset, reprinted from "Proceedings of the IRE", vol. 41, no. 10, October, 1953, pp 1325-1332, 8 pp, free

Description of properties, construction, and maintenance of the Logistics Computer, located at George Washington Univ., Washington, D. C.

Fairbanks, Ralph W. / Electronics Moves Into the Office / Fairbanks Associates, 248 Greenwich Ave., Greenwich, Conn. / 1953, printed, reprint from "Office Management", June 1953, 5 pp, free

Discusses the gap between the needs of management in offices and the construction programs of manufacturers of electronic data-processing machines, etc. Describes a book club application that used a combination of a standard punching machine, an addressing machine, and a sorting machine, all under the direction of an electronic control panel.

(continued on page 26)



PHOTOGRAPHS ACTUAL SIZE

...DEPENDABLE...LOW COST BORO-CARBON FILM RESISTORS

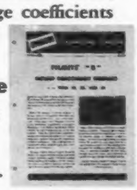
IN ½, 1, AND 2 WATT RATINGS

Now for the first time you can obtain a superior yet relatively low cost film-type resistor for military electronic gear—resistors that not only meet the severe performance requirements of Military Specification MIL-R-10509A, but are capable of full wattage dissipation at 70°C ambient!

Sprague Type 4E, 5E, and 6E Filmite B resistors are housed in a dense molded jacket which not only provides unexcelled physical protection for the film resistance element but serves as a barrier to moisture and vapor, the twin enemies of all film-type resistors.

Boro-carbon films are unusually sensitive to moisture. Protection against moisture in any form is a primary requirement for successful long term stability of resistance. The low-loss phenolic housings on molded Filmite resistors not only shed water but are vapor resistant and inert to the film material. There is minimum possibility of field failure through electrolytic action and penetration of moisture or vapor through the dense molded jacket.

Other features of molded Filmite B resistors are special low-contact-resistance, low noise end terminations held rigidly in place on special ceramic cores, extremely low temperature and voltage coefficients of resistance, and excellent load-life and high frequency characteristics.



For complete engineering data, write for Engineering Bulletin No. 130 to:

SPRAGUE ELECTRIC COMPANY,
00 Marshall Street, North Adams, Mass.

SPRAGUE TYPE NO.	WATTAGE RATING	DIMENSIONS (INCHES) L	D	RESISTANCE (OHMS) Min.	Max.	VOLTAGE (Max.)
4E	½	¾	¼	100	1 Meg.	350
5E	1	1$\frac{1}{16}$	⅜	100	2 Meg.	500
6E	2	2$\frac{3}{16}$	⅜	200	10 Meg.	750

Standard Resistance Tolerances: 1, 2, and 5%

SPRAGUE

PIONEERS IN ELECTRIC AND ELECTRONIC DEVELOPMENT

NORTH ADAMS, MASSACHUSETTS

EXPORT FOR THE AMERICAS: SPRAGUE ELECTRIC INTERNATIONAL LTD., NORTH ADAMS, MASS. CABLE SPREXINT

(continued from page 24)

Gruenberger, Fred / Computing News / Numerical Analysis Laboratory, University of Wisconsin, B-9 Bascom Hall, Madison 6, Wisconsin/ about 3 issues a month, dittoed, about 5 pp per issue, free if stamped self-addressed envelopes are sent in for each issue desired
News items, problems, and short reviews of information. Notes on card programmed calculator operations, statistics, matrices, etc.

Institute of Radio Engineers' Professional Group on Electronic Computers / Transactions, March 1954, vol. EC-3, no. 1 / Institute of Radio Engineers, 1 East 79 St., New York 21, N. Y. / 1954, photooffset, 39 pp (of which 8 are blank), $3.30 to non-members
Contains three technical papers, and reviews of 56 articles, papers, and books (some reprinted from other sources).

International Business Machines Corp. / Light on the Future / International Business Machines Corp., 590 Madison Ave., New York 22, N. Y. / 1953, printed, 30 pp, free
A well-written and interesting introduction to automatic computers (but without mention of any computers except Pascal's, Leibnitz's and IBM's). Chapters are: Two Families of Computers; Organization of Digital Computers; New Developments; What's Next; Glossary. The glossary contains 36 entries, but 46 terms since synonyms are pointed out.

International Business Machines Corp. / Principles of Operation, Type 701 and Associated Equipment / International Business Machines Corp., 590 Madison Ave., New York 22, N.Y./ 1953, printed, 103 pp, limited distribution
Describes the operation of an installation of IBM Electronic Data Processing Machines, including following units: Type 701 Analytical Control Unit, Type 706 Electrostatic Storage Unit, Type 711 Punched Card Reader, Type 716 Alphabetical Printer, Type 721 Punched Card Recorder, Type 726 Magnetic Tape Reader and Recorder, and Type 731 Magnetic Drum Reader and Recorder.

International Business Machines Corp. / Type 650 for Life Insurance Applications / International Business Machines Corp., 590 Madison Ave., New York 22, N. Y. / 1954, photooffset, 24 pp, free
Describes the calculation of dividends on ordinary life insurance policies using the IBM Type 650 automatic computer. The big advantage is that the dividend rate on the policy can be efficiently calculated from a formula as each policy comes along in random order, thus saving construction of a table of 200,000 entries, and lookup therein. In one case, 1320 hours of machine time were cut to 95 hours of machine time. The report also describes calculation of life insurance dividend tables, of nonforfeiture values in event of policy surrenders, etc.

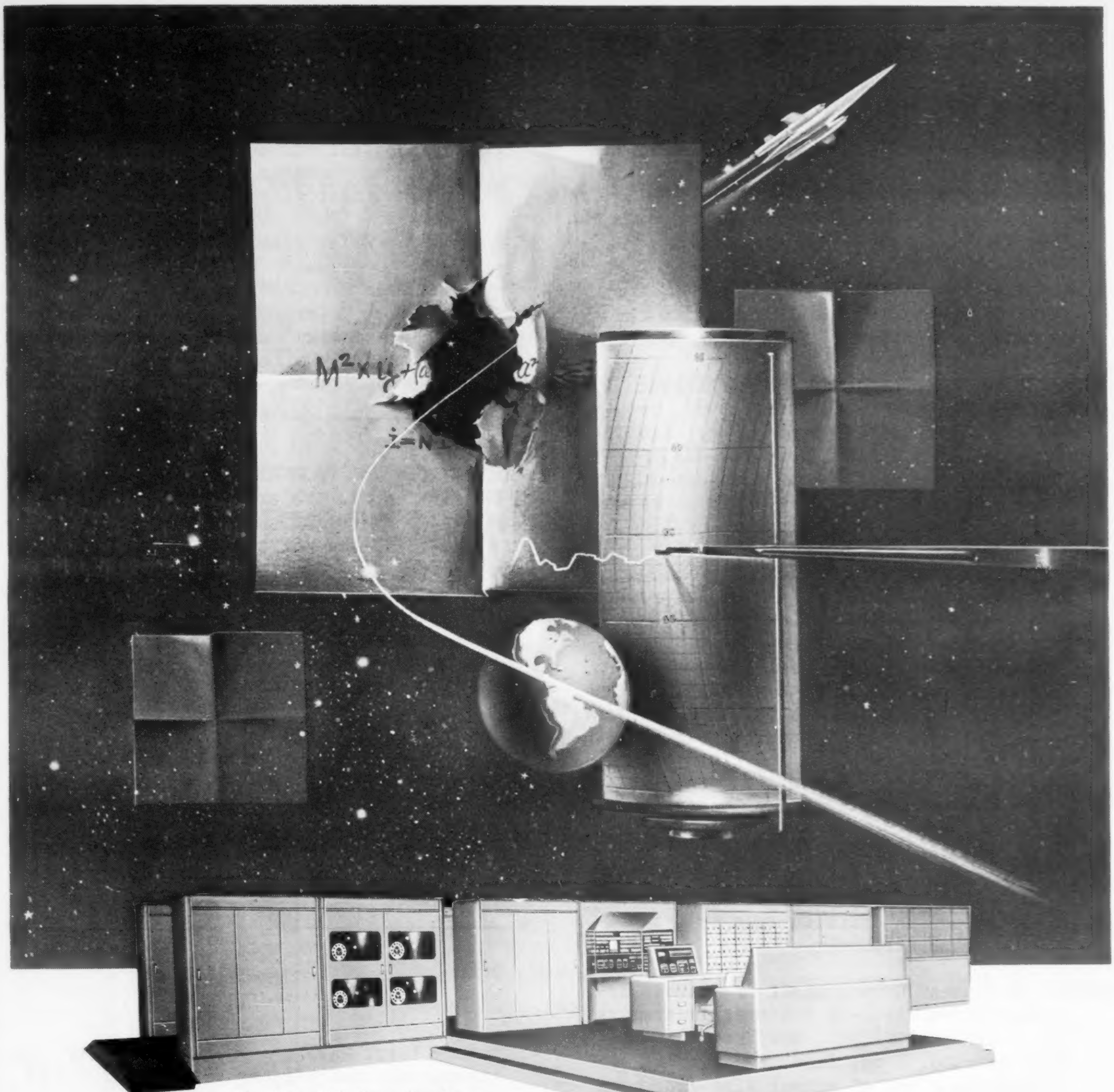
International Business Machines Corp. / Type 650 for Public Utility Customer Accounting/ International Business Machines Corp., 590 Madison Ave., New York 22, N. Y. / 1954, photooffset, 13 pp, free
Describes the application of the IBM Type 650 automatic computer to customer accounting in public utilities, gaining the advantage that the bill can be computed on the rate and use of each customer without table lookup; etc.

Joint IRE-AIEE-ACM Computer Conference, members of / Proceedings of the Eastern Joint Computer Conference / Institute of Radio Engineers, Inc., 1 East 79 St., New York 21, N. Y. / 1954, printed, 125 pp, $3.00
The theme of this conference was "information processing systems -- reliability and requirements". Contains 33 papers, addresses, and remarks; and reports of 20 discussions. Well printed and full of information, a good deal not technical.

Jones, Chalmer E. / "Computer Techniques in the Instrumentation Industries" in "ISA Journal, vol. 1, no. 2, February 1954 / Instrument Society of America, 1319 Allegheny Ave., Pittsburgh 33, Pa. / 1954, printed, $5 per year
Discusses use of an analog computer in problems in instrumentation; simulating a galvanometer, simulating process control, analysis of a motor controller.

Kahrimanian, Harry G. / Analytical Differentiation by a Digital Computer, Master's Thesis / Remington Rand, Inc., 1624 Locust St., Philadelphia, Pa. / May, 1953, dittoed, 49 pp, limited distribution
"Analytical differentiation by a digital computer" consists of determining and expressing the derivative (in the sense of the calculus) of any elementary function or finite combination of elementary functions by the application of computer operations. All the derivatives are expressed in a symbolic language which the computer Univac takes in and puts out. This report is technical, but it is important because it portrays the first use of an automatic digital computer to compute symbolic expressions involving mathematical operators -- not only numbers and instructions.

(continued on page 28)



The E.R.A. 1103 Computing System

Designed for Science

In many ways the E. R. A. 1103 is the most advanced data-handling system yet devised. By tremendous speed, large storage capacity, and great programming versatility, the system assures ideal handling of the most intricate computations.

Adding to its very high speed is an exceptionally fast memory-reference system which keeps the system's 17,408 internal storage registers directly accessible. Computing time is reduced still further — as is programming time — by use of a simplified form of two-address logic.

Another advantage of the 1103 is its ability to work well with virtually any input-output medium — magnetic tape, punched cards, line printer, electric typewriter, oscilloscope, and a wide variety of sensing devices. High computing speed and the facility for direct communication with external instrumentation enable the 1103 to handle large-scale operational problems in real time.

For information on how you can apply the 1103 to your particular application write on your business letterhead to . . .

Remington Rand INC

Electronic Computer Dept., Room 1578, 315 Fourth Ave., New York 10.

(continued from page 26)

Marchment, W. T. / "Application of Electronic Process Control to Oil Refineries" in "ISA Journal", vol. 1, no. 3, March 1954 / Instrument Society of America, 1319 Allegheny Ave., Pittsburgh 33, Pa. / 1954, printed pp 22-27, 75¢ per copy

This paper, by the Controls Manager, Evershed and Chiswick, London, describes the principles of operation of an electronic process control system in oil refining plants. Well-written, interesting, technical.

Prinz, D. G. / Robot Chess / Ferranti, Ltd., Moston, Manchester, England / 1952, printed, reprint from "Research", 6 pp, free(?)

Shows how a digital computer can be programmed to solve simple chess problems successfully, though it would do so more slowly than a human player.

Reeves Instrument Corp., staff of / Instrumentation Breadboard Parts / Reeves Instrument Corp., 215 East 91 St., New York 28, N.Y./ 1951, printed, 28 pp, free

Describes a standard set of gears, shafts, clamps, couplings, mechanical differentials, etc., which can be assembled (with motors, resolvers, synchros, etc.), like an Erector or Meccano Set, into an unlimited variety of combinations. The set produces a working "breadboard" (or prototype) model of a servomechanism, control device, or analog computer. The set may be used for turning a schematic diagram into a working model, without employing the drafting room or the model machine shop.

Reeves Instrument Corp., staff of /Reeves Instrumentation Paste-up / Reeves Instrument Corp., 215 East 91 St., New York 28, N.Y./ 1953, printed, 7 pp, free

Provides a set of actual size diagrams of miniaturized "breadboard" components (see above listed publication). They are printed on light cardboard, and may be cut out, physically assembled, and pasted down on a diagram of the mounting plate. This is a helpful intermediate step in the use of standard "breadboard" or prototype parts.

Remington Rand, Inc., Electronic Computer Dept. / The Programmer / Remington Rand, Inc., 315 Fourth Ave., New York 10, N. Y./ bimonthly, (vol. 1, no. 1, Dec. 1953; vol. 1, no. 2, Feb. 1954), printed, 4 pp, free limited distribution

Contains brief articles; The A-2 Compiler; New 3-Way Sorting Routine; ERA 1101 Computational Center; The Library of Subroutines; Univac Pulse Codes; etc.

Sigma Instruments, Inc. / "Sigma Instruments INK" / Sigma Instruments Inc., 170 Pearl St., South Braintree Rtl, Boston 85, Mass./ 1954, photooffset, 28 pp, $1.00

Contains reprints of Sigma ads "Crickets, Thermal Stability and Sigma Sensitive Relays", "Null Seeking Shark, Accompanied by Pilot Fish", "How We are Crowing with Good Caws", etc., and varied comments on FFLCCFAB, etc. from varied people. Returnable if not satisfactory. An interesting example of skillful and humorous marketing of components related to computers.

* ——— * ——— *

CORRECTIONS AND CHANGES: 1. In the January 1954 listing, in the entry: Edison, Julian E., and others "Electronics -- New Horizon in Retailing": the name of the third author is spelt Richard A. Pisitz.

2. In the March 1954 listing in the entry: Berkeley, Edmund C. "Glossary of Terms in the Field of Computing Machinery, Cybernetics, and Automation"; the number of pages is 12, not 2.

3. In the October, 1952 listing, in regard to the entry Office of Naval Research, "Digital Computer Newsletter": this is available now only to government agencies and their contractors, but it is being reprinted in the "Journal of the Association for Computing Machinery".

* ——— * ——— *

FORUM

(continued from page 13)

Little, Elbert Payson / techl dir / ACDP, instruction & teaching of the subject / '12, Harv Univ, '48, professor of physics

Livermore, Floyd G, Jr / jr asst prgrmr / MP / '28, Wayne Univ, '54, student

Peterson, H Philip / res assoc / DM / '31, Ohio Univ, '53, mathn & prgrmr

Skinner, Aileen M (Mrs) / res assoc / MP / '22, Wayne Univ, '53, prgrmr

Stines, Gladys R / res techn / - / - , Wash Sq Coll, NYU, '42, -

Sucher, Thomas E / res techn / M / '29, Wayne Univ, '48, techn

Zacharopoulos, George / res asst / E / '28, Wayne Univ, '47, techn

---

REPLY FORMS: Who's Who Entry; Reader's Inquiry

Paste label on envelope:↓ Enclose form in evelope:↓

BUSINESS REPLY LABEL
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

4¢ Postage Will Be Paid By —

EDMUND C. BERKELEY AND ASSOCIATES
36 West 11th Street
New York 11, N. Y.

FIRST CLASS
PERMIT NO 1680
Sec. 34.9, P. L. & R.
NEW YORK, N. Y.

IDENTIFICATION

Name (please print)........
Address........
Organization (& address)?........
Title?........

Please fill in completely

WHO'S WHO ENTRY FORM

Year of Birth?........

MAIN INTERESTS:
( ) Design
( ) Construction
( ) Applications
( ) Sales
( ) Electronics
( ) Mathematics
( ) Business
( ) Programming
( ) Other (specify):

College or last school?........

Year of entering the computing machinery field?........

Occupation?........ (Enclose more Information about yourself if you wish — it will help in your listing.)

READER'S INQUIRY FORM

Please send me additional information on the following subjects for which I have circled the CA number:

1 2 3 4 5	26 27 28 29 30	51 52 53 54 55	76 77 78 79 80	101 102 103 104 105	126 127 128 129 130
6 7 8 9 10	31 32 33 34 35	56 57 58 59 60	81 82 83 84 85	106 107 108 109 110	131 132 133 134 135
11 12 13 14 15	36 37 38 39 40	61 62 63 64 65	86 87 88 89 90	111 112 113 114 115	136 137 138 139 140
16 17 18 19 20	41 42 43 44 45	66 67 68 69 70	91 92 93 94 95	116 117 118 119 120	141 142 143 144 145
21 22 23 24 25	46 47 48 49 50	71 72 73 74 75	96 97 98 99 100	121 122 123 124 125	146 147 148 149 150

COMPUTERS AND AUTOMATION - Back Copies & Reprints

ARTICLES: October, 1952: Communication and Control in the Computing Machinery Field
The Parameters of Business Problems -- Edmund C. Berkeley
January, 1953: Brains: Electronic and Otherwise -- A. S. Householder
What Computers Do -- S. B. Williams
The Parameters of a Business Problem in Reading -- C. H. Dent
Automatic Computers on Election Night -- E. F. Murphy and E. C. Berkeley
March: Gypsy, Model VI, Claude Shannon, Nimwit, and the Mouse -- George A. W. Boehm, Science Editor, Newsweek
Water and Computers -- Henry M. Paynter, Jr., Mass. Inst. of Technology, and Neil Macdonald
The Concept of Automation -- E. C. Berkeley
The ERA 1103 Automatic Computer -- Neil Macdonald
April: The Art of Solving Secret Ciphers, and the Digital Computer -- Fletcher Pratt
Avenues for Future Development in Computing Machinery -- Edmund C. Berkeley
Hungarian Prelude to Automation -- Gene J. Hegedus
May: Compiling Routines -- Grace M. Hopper, Remington Rand
Mechanical Translation -- Andrew D. Booth, Birkbeck College, London
Medical Diagnosis -- Marshall Stone, University of Chicago
July: Machine Translation -- Y. Bar-Hillel, Mass. Inst. of Technology
Robot Traffic Policemen -- George A. W. Boehm, Science Editor, Newsweek
How to Talk About Computers -- Rudolf Flesch, Author of "Art of Plain Talk"
September: The Soviet Union: Automatic Digital Computer Research -- Tommaso Fortuna
Digital Computer Questionnaire -- Lawrence Wainwright
"How to Talk About Computers": Discussion -- G. G. Hawley and others
October: Computers in the Factory -- David W. Brown
The Flood of Automatic Computers -- Neil Macdonald
The Meeting of the Association for Computing Machinery in Cambridge, Mass., September, 1953 -- E. C. Berkeley
November: Who Will Man the New Digital Computers? -- John W. Carr III
Electronic Equipment Applied to Periodic Billing -- E. F. Cooley
Air-Floating: A New Principle in Magnetic Recording of Information -- Glenn E. Hagen
December: How a Central Computing Laboratory Can Help Industry -- Richard F. Clippinger
"Combined" Operations in a Life Insurance Company Instead of "Fractured" Operations -- R. T. Wiseman
"Can Machines Think?": Discussion -- J.L. Rogers and A. S. Householder

January, 1954: The End of an Epoch: The Joint Computer Conference, Washington, D. C., December, 1953 -- Alston S. Householder
Savings and Mortgage Division, American Bankers Association: Report of the Committee on Electronics, September, 1953 -- Joseph E. Perry and others
Automation in the Kitchen -- Fletcher Pratt
February: Language Translation by Machine: A Report of the First Successful Trial -- Neil Macdonald
Reflective Thinking in Machines -- Elliot L. Gruenberg
Glossary of Terms in Computers and Automation: Discussion -- Alston S. Householder and E.C. Berkeley
March: Towards More Automation in Petroleum Industries -- Sybil M. Rock
Introducing Computers to Beginners -- Geoffrey Ashe
Subroutines: Prefabricated Blocks for Building -- Margaret H. Harper
Glossaries of Terms: More Discussion -- Nathaniel Rochester, Willis H. Ware, Grace M. Hopper and others
April: Processing Information Using a Common Machine Language: The American Management Association Conference, February, 1954 -- Neil Macdonald
The Concept of Thinking -- Elliot L. Gruenberg
General Purpose Robots -- Lawrence M. Clark

REFERENCE INFORMATION (in various issues):

Roster of Organizations in the Field of Computers and Automation / Roster of Automatic Computing Services / Roster of Organizations Making Components / List of Automatic Computers / Who's Who in the Field of Computers and Automation / Books and Other Publications/ Glossary / Patents

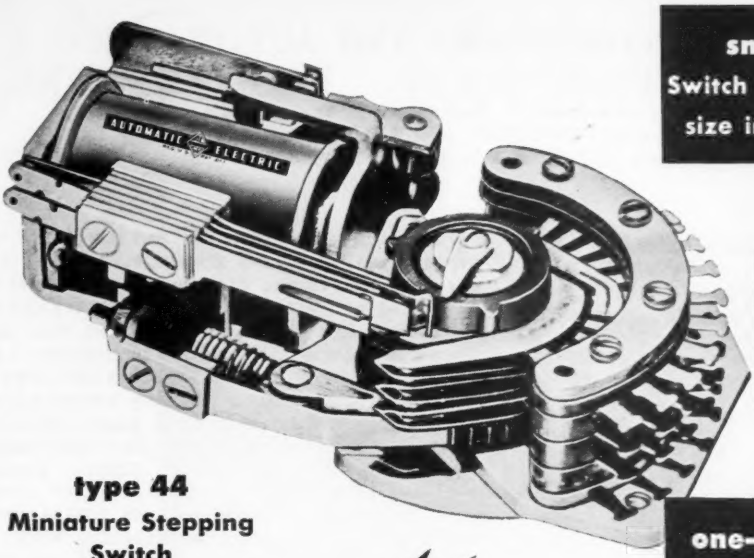
Price of back copies, if available, $1.25 each.

A subscription (see rates on page 4) may be specified to begin with any issue from March, 1954, to date.

REPRINTS: Index No. 1 (from December issue) -- 20 cents
Glossary of Terms in the Field of Computers and Automation (from three 1953 issues) -- 60 cents

WRITE TO:

Edmund C. Berkeley and Associates
Publishers of COMPUTERS AND AUTOMATION
36 West 11 St., New York 11, N. Y.

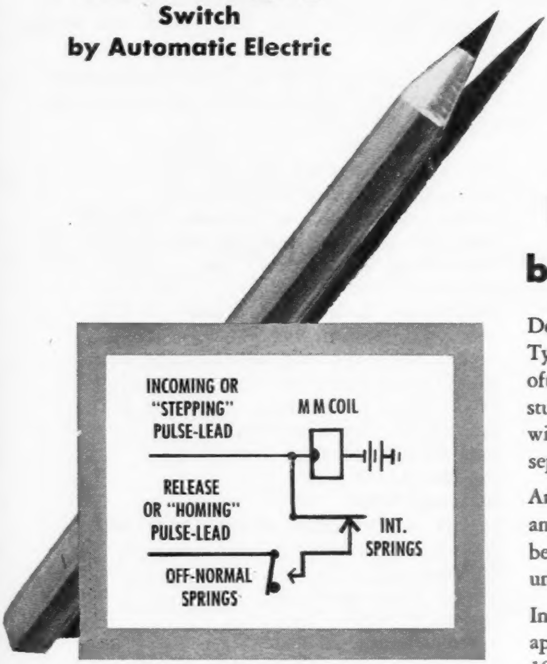


small size
Switch shown actual size in illustration

indirect drive design
For faster stepping and longer life

one-coil design
Cuts costs; separate circuit for "homing"

type 44
Miniature Stepping Switch
by Automatic Electric



How separate "homing" circuit is provided with one-coil operation

Interrupter contact springs open coil circuit near the end of each armature operation—causing switch to step by self-interruption, or by "door buzzer" action.

"Off-normal" contact springs close "homing" circuit on first step of wipers off home position and remain closed until home position is again reached. Thus, after the first step, a "homing" circuit is prepared, and the switch may be "homed" by simply energizing this circuit.

How to make a good product better...without increasing costs

Design engineers everywhere are choosing Automatic Electric's Type 44 Miniature Stepping Switch to insure long service life—often *reducing* costs as they do so! In countless applications, this sturdy switch has operated for more than 200 million operations, with little or no adjustment. The one-coil design eliminates a separate release coil—a saving passed on to the user.

And there are other reasons for such widespread approval: weight and space are saved; indirect drive design give smooth stepping and because there's no wiper "double loading" there's no "galloping"; the unique driving mechanism permits extremely high operating speeds.

Investigate Automatic Electric's Type 44 Switch for your control applications. Here's the first compact, lightweight switch to provide 10-, 20- or 30-point operations. Designed for any dc voltage up to 110, or, with an associated rectifier, for 115 volts 60 cycle ac. For more details on this and other Automatic Electric stepping switches, write for helpful engineering specifications to: Automatic Electric Sales Corporation, 1033 West Van Buren Street, Chicago 7, Illinois. In Canada: Automatic Electric Sales (Canada) Ltd., Toronto. *Offices in principal cities.*

RELAYS **SWITCHES**

PRODUCTS OF THE INDUSTRIAL DEPARTMENT OF

AUTOMATIC ELECTRIC

CHICAGO

ADVERTISING IN "COMPUTERS AND AUTOMATION"

Memorandum from Edmund C. Berkeley and Associates
Publishers of COMPUTERS AND AUTOMATION
36 West 11 St., New York 11, N.Y.

1. What is "COMPUTERS AND AUTOMATION"? It is a magazine published monthly, except June and August, containing articles and reference information related to computing machinery, robots, automatic controllers, cybernetics, automation, etc. One important piece of reference information published is the "Roster of Organizations in the Field of Computers and Automation". The basic subscription rate is $4.50 a year in the United States. Single copies are $1.25. The magazine was called THE COMPUTING MACHINERY FIELD until the March, 1953, issue; prior to that issue, it was published less often than ten times a year.

2. Who are the logical readers? The logical readers of COMPUTERS AND AUTOMATION are some 4000 persons who are concerned with the field of computers and automation. Many people are entering this field all the time. These include a great number of people who will make recommendations to their organizations about purchasing computing machinery, similar machinery, and components, and whose decisions may involve very substantial figures. We have been carefully gathering the names and addresses of these people for some time and believe we can reach them. The print order for the May issue was 1800 copies. The paid subscriptions on April 10, 1954 were a little over 1150. The overrun is largely held for eventual sale as back copies, and in the case of several issues the overrun has been exhausted through such sale.

3. What type of advertising does COMPUTERS AND AUTOMATION take? The purpose of the magazine is to be factual and to the point. For this purpose the kind of advertising wanted is the kind that answers questions factually. We recommend for the audience that we reach, that advertising be factual, useful, interesting, understandable, and new from issue to issue. We have had a number of comments expressing satisfaction with our style of advertising.

4. What are the specifications and cost of advertising? COMPUTERS AND AUTOMATION is published on pages 8½" by 11" and produced by photooffset. The closing date for any issue is approximately the 10th of the month preceding. If possible, the company advertising should produce final copy, which should be actual size and assembled, and may include typing, writing, line drawings, printing, screened halftones, etc. — any copy that may be photoffset without further preparation. If inconvenient to produce this, we will take rough copy and arrange with the printer to prepare it; there will be small additional charges in this event. Display advertising will be sold in units of full pages (ad size 7" by 10", basic rate $130), and half pages (basic rate $70): back cover, $250: inside front and back cover, $160. Extra for color red (full pages only and only in certain positions), 35%. Classified advertising will be sold by the word, with a minimum of ten words.

5. Who are our advertisers? Our advertisers in recent issues have included the following companies, among others:

- Automatic Electric Co.
- Burroughs Corporation
- Computing Devices of Canada, Limited
- Consolidated Engineering Corp.
- Electronic Associates, Inc.
- Ferranti Electric Co.
- Ferroxcube Corp. of America
- General Ceramics and Steatite Corp.
- Hughes Research and Development Lab.
- Intelligent Machines Research Corp.
- International Business Machines Corp.
- Laboratory for Electronics
- Logistics Research, Inc.
- The Macmillan Co.
- Monrobot Corp.
- George A. Philbrick Researches, Inc.
- Potter Instrument Co.
- Raytheon Mfg. Co.
- Reeves Instrument Co.
- Remington Rand, Inc.
- Sprague Electric Co.
- Sylvania Electric Products, Inc.
- Telecomputing Corp.

ADVERTISING INDEX - MAY, 1954

The purpose of COMPUTERS AND AUTOMATION is to be factual, useful, and understandable. For this purpose, the kind of advertising we desire to publish is the kind that answers questions, such as, What are your products? What are your services? And for each product, What is it called? What does it do? How well does it work? What are its main specifications? Adjectives that express opinion are not desired. We reserve the right not to accept advertising that does not meet our standards.

Every advertisement in this issue, we believe, is factual and objective. For these reasons, we think that the advertising is likely to be worth reading. So far as we can tell, the statements made are reasonable, informative and worth considering.

Following is the index to advertisements:

If you wish more information about any of the products or services mentioned in one or more of these advertisements, you may circle the appropriate CA No.'s on the Reader's Inquiry Form (see page 29) and send that form to us -- we pay postage (see the instructions). We shall then forward your inquiries, and you will hear from the advertisers direct.

e.
s
h
n
e

se
ve

ge

1

9
0
4

1

9

5

9

3

3

1

7

5

5
6

2

e
r's
-
r-